The quality of specimens obtained by fine-needle aspiration biopsy: does training make a difference?

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Abstract

Background: The aim of this study was to determine the outcome of a one-hour training session on the correct technique of fine-needle aspiration biopsy (FNAB) by assessing adequacy of FNAB specimens received from clinicians at an academic hospital.

Method: Six clinicians were recruited and their FNABs assessed, six months prior to, and then again after, a one-hour training session in correct technique. Questionnaires were completed prior to the training session and after the subsequent six-month period, to determine the subjective assessment of the clinicians' perceived value of the training on their aspiration technique.

Results: Five of the clinicians had never received training in FNAB technique. The adequacy of the aspirates for all six clinicians did not improve, although this was not statistically significant. They performed a median of 15.5 FNABs in the six months prior to training, and 13.5 FNABs in the six-month follow-up period. Five of the six clinicians subjectively perceived the quality of the aspirates to have improved, and all six recommended the training session to their colleagues.

Conclusion: No improvement was noted after training, but the number of FNABs performed per clinician was suboptimal. Previous studies have shown that clinicians performing relatively few aspirates perform poorly, even if they have received adequate training. The fact that all six would recommend the training session to colleagues is encouraging, and the authors recommend that formal training in FNAB technique should be included in the undergraduate medical curriculum.

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Background

Fine-needle aspiration biopsy (FNAB) can be defined as the removal of a sample of cells, using a fine needle, from a suspicious mass for diagnostic purposes.[1] The first description of the use of needles for therapeutic purposes was provided by an Arab physician, Abu al-Qasim Khalaf ibn al-Abbas al-Zahrawi (also known as Albucasis or Abulcasim). He was born between 936 and 940 near Cordoba in Spain, and died in 1013. He discussed needle puncture of the thyroid to diagnose different types of goitre in his famous treatise, *Kitab al-Tasrif* (the method of medicine).[1-3] In its current form, needle aspiration biopsy was first recorded by Kün in 1847, in a paper entitled "A new instrument for the diagnosis of tumours".[1,2]

FNAB is a simple, safe, and cost-effective procedure for the investigation of patients with a mass lesion.[4] The procedure can be carried out on an outpatient basis, or at the patient's bedside, and no dietary restriction or pre-procedure preparation is required. No anaesthesia is necessary, and it is much cheaper to perform than a formal surgical biopsy.[4] Direct FNAB can be used for superficial masses, such as breast, thyroid, lymph node, and salivary gland lesions, while ultrasound or computed tomography can be used to aspirate deep-seated lesions, including lung, liver, and kidney masses.[4]

Although most pathologists and clinicians who use FNAB are aware of the relationship between expertise in microscopic interpretation and diagnostic accuracy, the importance of sample quality and smear preparation is not as well recognised. Several studies have shown that training and experience in obtaining, and preparing, the samples, play a major role in the efficacy of the method.[5] However, most previous studies have concentrated on a single-organ system. Therefore, the aim of this study was to determine if training in FNAB technique would improve the overall adequacy of fine needle aspirates performed by clinicians.

Method

This study consisted of a retrospective and a prospective component. Clinicians working at the Universitas Academic Complex, University of the Free State, Bloemfontein, who perform a minimum of 10 FNABs in a six-month period, were asked to participate. Informed consent was obtained from participants, and each clinician was given an identifying number to ensure confidentiality. In the retrospective component, all FNABs performed by each participating clinician over a six-month period were obtained from the Department of Anatomical Pathology, Division of Cytology archives. The clinicians then attended a training session, where they were asked to fill in a short questionnaire. The questions included whether or not they had received training in the past, how often they performed FNABs, and whether or not they thought they knew how to perform an FNAB correctly. They were then given a one-hour training session, which included a demonstration on how to perform an FNAB correctly, together with a practice session, where they performed FNABs on a chicken breast containing liver (to mimic a mass within a breast). The session was based on training that was given to medical students and registrars at the Stellenbosch University, provided by the Division of Anatomical Pathology. Each participant was provided with a printed summary of the correct FNAB technique, to use for future reference. All FNABs performed by the clinicians in the six months after the training session were included in the prospective portion of the study. The clinicians worked in the same hospitals and under the same conditions, both before and after the training session. Therefore, there were no confounding factors. A short follow-up questionnaire was completed by each participant after the second six-month period.

All the FNABs were evaluated using a scoring system adapted from a system obtained from an article by Baksh et al (see Table I).[6] An overall grading system was also used (see Table II).

Any cases which were acellular, or consisted only of blood, were given a score of 0.

All the specimens were scored and graded by one pathologist, while 20% of cases that were randomly selected were scored and graded by a second pathologist. During evaluation, the pathologist did not know which clinician performed the FNAB, and whether or not the FNAB was performed before or after the training session, in order to avoid bias. There was consensus between the two pathologists' scores. Results were summarised by means and standard deviations (SDs), or percentiles, and frequencies and percentages. Differences between before, and after, training, were assessed using chi-square or Fisher's exact test, per clinician.

Ethics approval was obtained from the ethics committees of the University of the Free State (Faculty of Health Sciences), and Stellenbosch University.

Table I: Scoring system adapted from Baksh et al[6]

Cellularity	Insufficient material for diagnosis	0
	Adequate for diagnosis	1
	Excellent aspirate with abundant material	2
Background blood	Abundant, obscures cellular detail, prevents diagnosis	0
	Moderate amount, does not affect diagnosis	1
	Absent or minimal	2
Degree of cellular degeneration and trauma	Severe, obscures cellular detail, prevents diagnosis	0
	Moderate, does not affect diagnosis	1
	Absent or minimal	2
Incorrectly spread or clumped material	Severe, obscures cellular detail, prevents diagnosis	0
	Moderate, does not affect diagnosis	1
	Absent or minimal	2
Retention of appropriate architecture	Minimal, to absent	0
	Moderate, some preservation of follicles, papillae and acini	1
	Excellent architectural features, closely reflecting histology	2
Total		10

Results

Only six clinicians were found to have performed sufficient FNABs to qualify for the study, and all six agreed to participate. Five were from the Department of Oncotherapy, including four registrars and one medical officer, while one was a registrar from the Department of Surgery. Only one clinician stated that he or she had received previous training in FNAB technique during his or her intern year. The other five had never received training. All six stated that they had performed FNABs on a weekly basis. Four of the clinicians felt that they knew how to perform an FNAB correctly, while two indicated that they did not. In the six-month period prior to training, each clinician performed between 12 and 27 FNABs (median 15.5), while in the follow-up period, the number ranged from 8-33 FNABs (median 13.5) per clinician (see Table III). The majority of aspirates, both before and after training, were of lymph nodes and breast lesions. Of the aspirates performed prior to training, 48.1% were

Table II: Grading system

I	Inadequate, or not representative of the lesion
II	Suspicious, but not diagnostic
III	Diagnostic of the lesion

Table III: Number of aspirates performed by each clinician, before and after training

Clinician	Number of aspirates performed before training	Number of aspirates performed after training
Clinician 1	27	21
Clinician 2	22	33
Clinician 3	15	14
Clinician 4	16	13
Clinician 5	14	10
Clinician 6	12	8

Table IV: Results for six clinicians using the scoring system adapted from Baksh et al[6]

	Score	Before	After
Cellularity	0	21.2%	42.1%
	1	63.5%	34.5%
	2	15.4%	23.4%
Background blood	0	22.5%	38.9%
	1	56.5%	42.8%
	2	21.0%	18.3%
Degree of cellular degeneration and trauma	0	24.5%	45.2%
	1	60.0%	22.3%
	2	15.5%	32.5%
Incorrectly spread, or clumped material	0	19.5%	40.6%
	1	52.4%	20.4%
	2	28.1%	39.0%
Retention of appropriate architecture	0	46.7%	54.4%
	1	51.6%	40.7%
	2	1.7%	4.9%

of lymph nodes and 20.8% of breast lesions, while after training, 57.8% were lymph node aspirates and 10.1%, breast aspirates.

All six clinicians performed less well after training, with a mean total score (out of 10) of 4.5 (SD 0.8, range 3.6-5.5), dropping to a mean total score of 4 (SD 1, range 2.5-5.5) (see Table IV). The overall grade was also worse after training, with 29.5% of smears graded as inadequate (Grade I) prior to training, increasing to 44.4% following training. However, this was not statistically significant for any of the clinicians. The number of diagnostic smears decreased from 55.7% prior to training, to 41.4% after training (see Table V).

In the follow-up questionnaire, five of the six clinicians said they thought that the quality of their aspirates had improved following training, and all six said that they would recommend the training to colleagues.

Discussion

Ljung et al[7] reviewed 1 043 consecutive FNABs of palpable breast lesions performed over a one-year period. The

Table V: Results of the grading system for each clinician, before and after the training session

Clinician	Grade	Before	After
Clinician 1	I	14.8%	23.8%
	II	14.8%	23.8%
	III	70.4%	52.4%
Clinician 2	I	36.4%	48.5%
	II	9.1%	6.1%
	III	54.6%	45.5%
Clinician 3	I	20.0%	35.7%
	II	13.3%	7.1%
	III	66.7%	57.1%
Clinician 4	I	37.5%	46.2%
	II	18.8%	15.4%
	III	43.8%	38.5%
Clinician 5	I	28.6%	50.0%
	II	14.3%	20.0%
	III	57.1%	30.0%
Clinician 6	I	41.7%	62.5%
	II	16.7%	12.5%
	III	41.7%	25.0%

results of formally trained physicians were compared with those of physicians who had not been so. The formally trained physicians had completed fellowship training in cytopathology or the equivalent, during which they performed at least 150 FNABs under supervision, while those without formal training had read a description of the technique, attended a lecture, watched another physician perform the procedure a few times, or had performed less than 10 FNABs under supervision. The formally trained physicians performed at least 100 FNABs during the year-long study period, while the untrained physicians performed a median of two. It was found that formally trained physicians missed two per cent of cancers, while physicians who had not received formal training missed 25%. Specimens obtained by the formally trained doctors were significantly more cellular, and were significantly less likely to be non-diagnostic. The findings suggest that formal training significantly improved the diagnostic accuracy of FNAB. As cited by Ljung et al,[7] Lee et al found that a physician performing a larger number of FNABs had a significantly lower rate of non-diagnostic specimens, compared to physicians in the same community, who performed a few FNABs only.

Despite the fact that five of the six clinicians who participated in this study thought that the quality of their aspirates had improved after the training session, results demonstrated that all six actually showed a minimal decrease in performance. This may be due, in part, to the fact that the training session was only an hour long, and that they did

not perform any FNABs under supervision after the session. This clearly does not comply with what Ljung et al[7] regard as formal training. Clinicians may also have felt more confident following the training session, and may have attempted to aspirate lesions which they would have avoided in the past. A further factor is that they only performed between 8 and 33 FNABs in the six-month follow-up period, with a median of 13.5 aspirates. This is less than one FNAB per week in some cases, and is suboptimal. Pleat et al[8] showed that clinicians who performed relatively few aspirates may do poorly with regards to specimen adequacy, even if they have received training. More experience using the new technique may have resulted in a better performance. The participating clinicians have been notified regarding the findings, and will be offered further training to improve their technique. They will also be encouraged to perform a greater number of FNABs in the future.

None of the six clinicians received instruction on how to perform an FNAB during their undergraduate medical training. The Division of Anatomical Pathology at Stellenbosch University runs an FNAB clinic, staffed by pathology registrars and a nursing sister. Clinicians can refer patients for FNABs, and medical students also receive training in the clinic. Ideally, such a clinic should be implemented at all the universities in South Africa, although in some centres, staffing and logistical issues preclude this. In light of the fact that FNAB is a simple, safe, and cost-effective way to diagnose a mass lesion, the authors think that it is important that provision is made for formal training in the undergraduate medical curriculum. This should include the performance of at least 50 FNABs under supervision, which should be recorded in a log book. Training should also be provided to registrars in departments such as surgery and oncology, if they did not receive it during their undergraduate studies.

Conflict of interest

The authors declare no conflict of interest.

References

1. De May R. The art and science of cytopathology. Hong Kong: ASCP Press, 1996; p. 464-465.
2. Diamantis A, Magiokinis E, Koutselini H. Fine needle aspiration (FNA) biopsy: historical aspects. Folia Histochem Cytobiol. 2009;47(2):191-197.
3. Abu al-Qasim Khalaf ibn al-Abbas Al-Zahrawi, known as Albucasis (936-1013). Science Museum [hompeage on the Internet]. c2011. Available from: http://www.sciencemuseum.org.uk/broughttolife/people/albucasis.aspx
4. Wu M, Burstein DE. Fine needle aspiration. Cancer Invest. 2004;22(4):620-628.
5. Koss LG. Koss' diagnostic cytology and its histopathologic bases. 5th ed. Philadelphia: Lippincott, Williams and Wilkins, 2006; p.1057.
6. Baksh S, Masih K, Sing S, et al. Diagnostic utility of fine needle non-aspiration cytology versus fine needle aspiration cytology in breast masses. Indian J Pathol Microbiol. 2004;47(3):319-321.
7. Ljung B, Drejet A, Chiampi N, et al. Diagnostic accuracy of fine needle aspiration biopsy is determined by physician training in sampling technique. Cancer Cytopathol. 2001;25(93):263-268.
8. Pleat JM, Dunkin CSJ, Tam N, et al. Fine needle aspiration in plastic surgery outpatients: a retrospective study. Cytopathology. 2003;14(6):332-337.